BOTANICA

MONOGRAPH OF THE GENUS ELODEA
(Hydrocharitaceae)

PART 2. THE SPECIES FOUND IN THE ANDES AND WESTERN SOUTH AMERICA

BY

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INTRODUCTION

The genus *Elodea* Richard in Michaux was first published in 1803 (Fl. Bor.-Am. 1: 20, 1803), based upon the single species. *E. canadensis* from Montreal, Quebec, Canada. Though this was stated to have perfect flowers, it is now certain that the holotype specimens and the plants in nature are dioecious. Very abundant are plants bearing pistillate flowers with three stigmas and three acicular staminodia. Staminate plants are rare, but occur throughout the natural range of the species. Their flowers have nine stamens, but no trace of a gynoecium. Two well known species are now separated and placed in the genus *Egeria* Planch., a group just monographed by the writer. Left in *Elodea* are seventeen species. These are to be found in two broad areas, the northern ones in the United States and southern Canada; the southern ones in South America. As yet there is no evidence of any indigenous species of *Elodea* in Central America.

The significant specific characters are to be found in the flowers. However, these are minute, ephemeral, and rarely present on herbarium specimens. Consequently the regional key here presented is an artificial one, based primarily on herbage characters.

The author is publishing this monograph of *Elodea* by dividing it into parts to be printed in different magazines.

The abbreviations used in the citation of specimens are those chosen by J. Lanjouw and F. A. Stafleu (Regnum Veg. 15: 1959).

Key to Subgenera and Sections

Flowers perfect, subgenus *Apalanthe.*
Flowers dioecious, subgenus *Elodea.*
Staminate flowers protruded from the spathe by the elongating, filiform base of the hypanthium, not liberated. section *Elodea.*
Staminate flowers sessile, at anthesis liberated, floating to and expanding on the surface of the water. section *Natator.*

Artificial Key to the Species

Middle and upper leaves in whorls of 7, or occasionally of 5; lower leaves alternate; flowers perfect. 8. *E. granatensis.*
Middle and upper leaves in whorls of 3-4; lower leaves opposite; flowers dioecious,
Middle and upper leaves 2-4.5 mm. wide, in whorls of 3-4. 11. *E. Potamogeton.*
Middle and upper leaves 1-2.3 mm. wide, in whorls of 3,
Stigmas entire; staminate sepals 4.5 mm. long. 12. *E. titicacana.*
Stigmas bifid; staminate sepals 5-6 mm. long,
Pistillate sepals 3 mm. long; staminate sepals ovate; staminate petals 1.5 mm. wide. 10. *E. peruviensis.*
Pistillate sepals 2.4-2.6 mm. long; staminate sepals elliptic; staminate petals 1.8-2 mm. wide. 9. *E. Matthewsii.*

Taxonomic Treatment

3. **Elodea granatensis** Humb. & Bonpl., Pl. Aequin. 2: 150, pl. 128, 1809; *E. guyannensis* Rich., Inst. de France, Mém. 12(2): 4-7, pl. 1 (1811) = 1814; *E. orinocensis* (as *Orinocensis*) Rich., Inst. de France, Mém. 12(2): 75, (1811) = 1814; *E. guyannensis* Rich. var. *dicranoides* Casp., Kgl. Preuss. Akad. Wissensch., Monatsber. 1857: 48, 1857; in reprint, p. 12, 1857; and in Pringsheim's Jahrb. Wissensch. Bot. 1: 502, 1858; *Apalanthe granatensis* (Humb. & Bonpl.) Planch., Ann. & Mag. Nat. Hist. II, 1: 87. 1848; *A. guyannensis* (Rich.) Planch. (as *guyanensis*), Ann. & Mag. Nat. Hist. II, 1: 87. 1848; *Udora granatensis* (Humb. & Bonpl.) Spreng., in Linnaeus' Syst. Veg., ed. 16 by

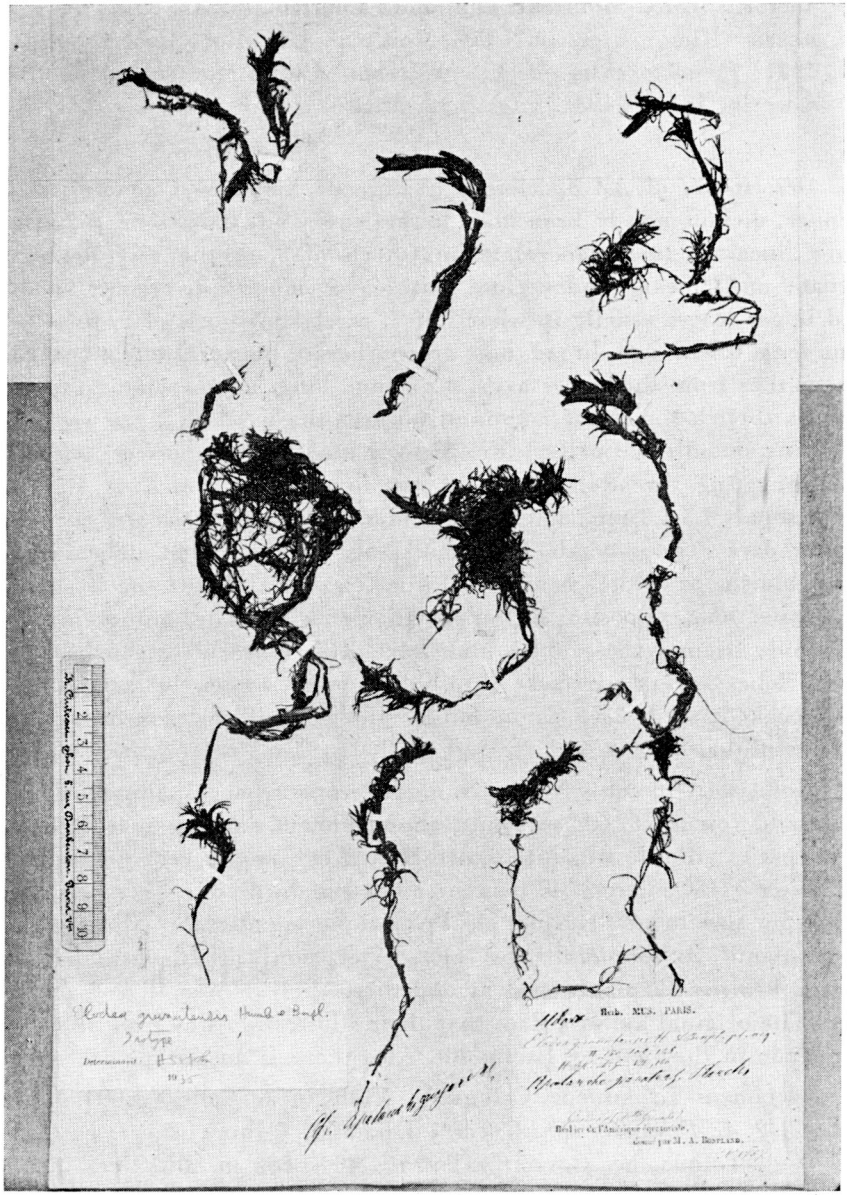

Fig. 1. *Elodea granatensis* Humb. & Bonpl., photo of holotype.

Spreng. 4(2): 25, 1827; *Philotria granatensis* (Humb. & Bonpl.) Victorin, Univ. Montréal, Lab. Bot., Contrib. 18: 42, 1931; *P. guyanensis* (Rich.) Victorin, Univ. Montréal, Lab. Bot., Contrib. 18: 42, 1931; *P. orinocensis* (Rich.) Victorin, Univ. Montréal, Lab. Bot., Contrib. 18: 42, 1931. (figs. 1, 2, 3, c, 5, e, f, 8).

Description of All Specimens Examined: Submersed aquatic; stems slender, dichotomously branched; lower leaves 9-14 mm. long, 1-2.5 mm. wide, linear to linear-lanceolate, in whorls of 3, or the very lowest alternate and linear; nodes close but leaves mostly divergent; median and upper leaves usually in whorls of 7, rarely in whorls of 5, these 7-20 mm. long, 0.5-1.5 mm. broad, pale green, flaccid, linear, attenuate, serrulate; spathes from the upper axils, 4.2-5 mm. long, 1 mm. wide, nearly cylindric, though somewhat narrowed towards the base, cleft $^1/_3$ way, with a gaping, mouth-like orifice, the teeth acute; flowers perfect, borne on the elongating, thread-like base of the hypanthium which is 1.2-6 cm. long; sepals 1.5-1.8 mm. long, 0.7-0.8 mm. wide, oblong, acute, cucullate, lightly dark-striate; petals 2.2-3 mm. long, 1.5 mm. wide, delicate, pale lilac, bluish, or white, broadly elliptic, clawed at base; the 3 stamens 1-1.2 mm. long, opposite the sepals, filaments subulate, anthers broadly ellipsoid; stigmas three, 0.7-1 mm. long, 2-cleft nearly to the base into linear lobes; ovary narrowly ellipsoid; capsule 4 mm. long, lance-ellipsoid, beaked; seeds 2.5-2.8 mm. long, cylindric-fusiform, greenish, appressed hirsutulous.

Holotype: "in aquis Novae Granatae, prope urbem Guaduas". The authors add (on p. 152): "se trouve abondamment dans les mares voisines de la petite ville de Guaduas, entre Honda et Cune, à cent quatre-vingt-dix toises (1150 mètres) de hauteur au-dessus du niveau de la mer". The holotypic specimen: "Herbier de l'Amerique equatoriale, Nlle Grenade, donné par *M. A. Bonpland 1,757*" (P). Type examined! It consists of three sheets, bearing 17 plants, and among these there is one flower and one bud. The original authors state that their illustration was from the drawing made in the field by Humboldt. Also there is an isotype (B).

Specimens Examined: Colombia: Valle, near Cauca, 1,000 m. alt., Feb. 1942, *E. Dryander 2,618* (US); La Paila, 4 June 1853, *I. F. Holton 138* (G); Tolima, bei Garzón y Tolima, 400-1,200 m. alt., Dec. 1882, *F. C. Lehmann 2,287* (BM); without locality, 1828, *Parker* (G); agua dulce entre Ibagué y Piedras, Tolima, Oct. 1868, *A. Stübel 194c* (B).

Venezuela: Bolívar, La Paragua, in semistagnant stream, sabanas, 285 m. alt., April 22, 1943, *E. P. Killip 37,595* (US); Sumpf, Las Botellas,

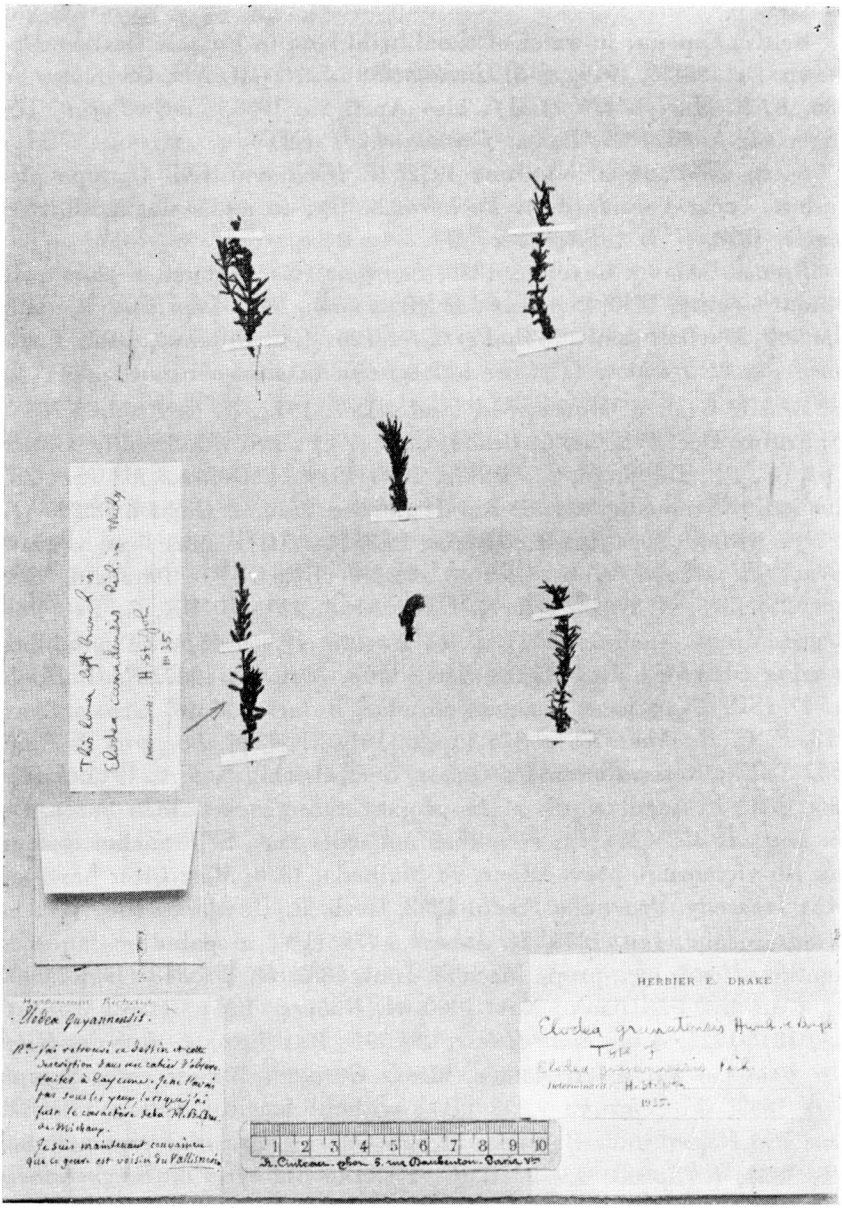

Fig 2. *Elodea granatensis* Humb. & Bonpl., photo of holotype of its synonym *E. guyannensis* Rich.

Deutsche Caura-Expedition, Venezolanisches Guiana, *Passarge & Selwyn 315* (B).

British Guiana: in water of canal, wild land in Botanic Garden, Georgetown, Oct. 24-26, 1919, *A. S. Hitchcock 16,532* (GH, NY, US); also Feb. 1936, *E. B. Martyn 425* (GH); also April 25, 1933, *T. G. Tutin* (US); immersed, April 1889, Lama, *Jenman 4,791* (NY).

Surinam: Paramaribo, June 1932, *G. H. Bünzli* (ZT); prope plant. Jagslust, (near Paramaribo), *Focke 602* (U); in aquis stagnantibus, Surinami, 1838, *F. L. Splitgerber* (G).

French Guiana: Cayenne, 1839, *Leprieur* (G); Aroura, *Leprieur* (B); without locality, 1850, *Leprieur 138* (B); same, 1850, *Leprieur* (P); same, *Leprieur 26* (B); same, 1821, *Perrottet 198* (G); Guianne, 1811, *Jussieu*, donné par *M. Richard* (P), the holotype of *E. guiannensis* Rich.

Brasil: Graben, Moóca, São Paulo, Dec. 1912, *A. C. Brade 5,795* (S, SP); ditto, Dec. 1912, *A. C. Brade 6,409* (ZT); Prov. de Piauhy, *Gardner 2,742* (G, P); Butantan, São Paulo, 12/5/1919, *A. Gehrt 3,333* (SP, ZT); dans le Rio Arapuahy, env. de Rio de Janeiro, Juin, *A. Glaziou 13,290* (BR, G, P); without locality, *A. Glaziou 14,355bis* (C); dans l'eau courante, Goyaz, *Chico Lobo (Herb. Glaziou) 22,230* (BR, G, P); Paracatu, Minas, Sept. 25, 1895, *A. Glaziou & R. Letegrier 22,229* (B, BR, G, P); Pouso Alegre, Minas, April 28, 1927, *F. C. Hoehne 19,260* (SP, ZT); submersa na aqua corrente, Mogi-Mirim, São Paulo, May 25, 1927, *F. C. Hoehne 20,549* (SP, ZT); lagos e aquas paradas, Rosario, Matto Grosso, March 1918, *F. C. Hoehne* (ZT); São Paulo, July 21, 1894, *Loefgren & Edwall 2,562* (ZT); Retiro, Serra dos Ogaôs, Centralstock, Nov. 1, 1915, *Luetzelburg* (M); in stagnis aquis pigris prope Guarantingueta, São Paulo, Dec., *von Martius 453* (M); in recesubus aquarum fluv. S. Francisci e stagnorum illi vicinorum, prov. Minar, ad Malhada, 1818, *Martii* iter brasiliense (M); Jacaredy, Prov. São Paulo, 1888, Herb. *R. Mendonça 688* (B); Santos Sororocaba, Jan. 1875, *H. Mosén 3,479* (P); in paludibus aquis stagnantibus, fossis etc., prope Macahé, Juni, 1882, *Riedel 848* (B); 2,000 ft. alt., Cruzeiro, São Paulo, Nov. 1900, *A. Robert* (BM); Prov. Minas Geraes, 1816-1821, *A. de Saint-Hilaire B1,591* (P); ditto, *A. de Saint-Hilaire* (P) Sitio bei São Bartholoméo, Minas Ger., im Wasser eines Sumpfes, Marz 1893, *W. Schwake 9,298* (B); without locality, *Sellow* (B, BR); secus Rio Negro, inter Barcellos et San Gabriel, Brasiliae septentrionalis, Dec. 1851, *R. Spruce 1,991* (B, G, P), the holotype of *E. guyannensis* Rich. var. *dicranoides* Casp.; in Bächen bei Inhomerim, Est. de Rio de Janeiro, Oct. 1896, *E. Ule 4,074* (B); in einem Bach bei S. Bento, Rio Branco, Jan. 1909, *E. Ule 7,758* (B); same, but Capella, Jan. 1909, *E. Ule 7,758* (B); Belemzinho, São Paulo, 15 Abril, 1906, *A. Usteri* (ZT); in lo-

cubus aqua stagnante, Lagoa Santa, 26 Jan. 1886, *E. Warming 1,103* (C); same, *Warming* s. n. (P); Prov. Matto-Grosso, Juillet et Août, 1845, *H. A. Weddell 3,367* (P).

Argentina: Laguna Ibera, Ihusaingo, Rio Albo, Parana, 15 April 1883, *G. Nuderlein* (B).

Discussion: *E. granatensis* is a member of the subgenus *Apalanthe*. The holotype of this subgenus is *E. guyannensis* Rich. (1814) which is a synonym of *E. granatensis* Humb. & Bonpl. (1809).

The holotype of *E. guyannensis* Rich. in the Paris Museum consists of two sheets, the first with seven branches, two of which bear broken hypanthia, and one other bears an old, badly withered flower, and still another bears two flowers showing the sepals, petals, stamens and stigmas. The second sheet bears five short sterile branches, four of which are of this species. The plant in the lower left hand corner is stouter and coarser, with lance-oblong, firm, imbricate leaves attached in 2's or 3's. It is evidently a specimen of *E. canadensis* Rich. in Mich.

E. guyannensis Rich. var. *dicranoides* Casp. was based upon a Brasilian collection from Rio Negro, Spruce 1,991. As none of the differences alleged to separate this from the species are real, and as no other have been found, it is reduced to the synonymy of the species.

E. granatensis occurs from Colombia, east to French Guiana, and south to Argentina. It has by far the widest distribution of any of the species on the continent.

9. **Elodea Matthewsii** (Planch.) St. John, Darwiniana 12: 307. 1961. *Anacharis Matthewsii* Planch., Ann. Mag. Nat. Hist. II, 1: 86, 1848; and Ann. Sci. Nat. Bot. III, 11: 73-74, 1849. (Figs. 4, a, b, 5, a, b, 8).

Description of All Specimens Examined: Submerged aquatic; stems slender, dichotomously branched; lower, median, and upper leaves in whorls of 3, and 6-14 mm. long, 1.1-2.3 (-3) mm. wide, linear, abruptly subacute, minutely appressed ciliate-serrulate, especially toward the tip, the leaves dark green, firm, divergent, but usually closely approximate due to the very short internodes; flowers dioecious; staminate plants with spathes single, from the middle axils, the upper portion 6-7 mm. long, 3.5-4 mm. broad, narrowly obovoid, cleft nearly half way, the two teeth forming a gaping, mouth-like orifice; the lower portion 12-19 mm. long, elongate and peduncle-like; staminate flowers protruded on the thread-like peduncle-like hypanthium, which becomes as much as 7 cm. in length; sepals 5-6 mm. long, 2.1-2.5 mm. wide, elliptic, somewhat concave and the margins slightly upturned, texture firm, greenish, the margins

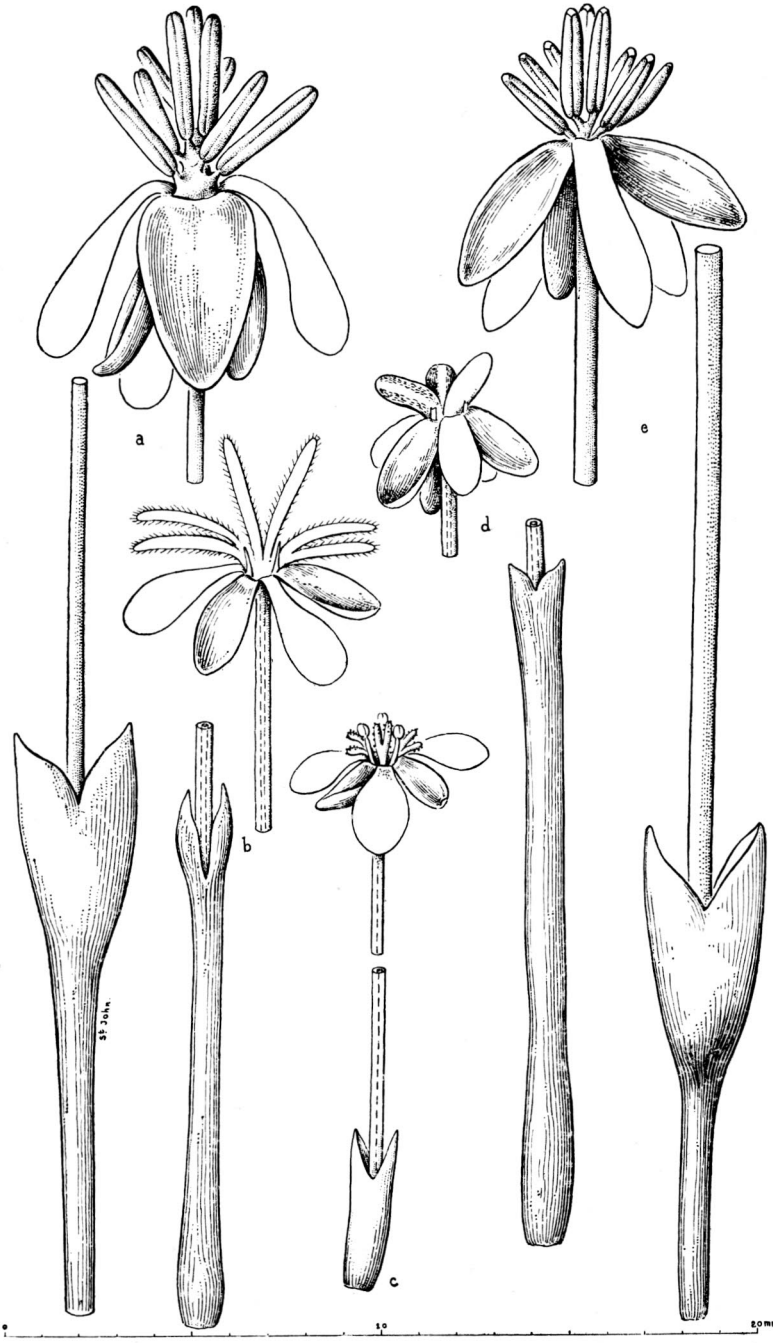

Fig. 3. *a*, *Elodea peruviensis* St. John, from holotype, staminate flower, X 5; and *b*, pistillate flower, from R. S. Williams 2,516, X 5; *c*, *Elodea granatensis* Humb. & Bonpl., from A. S. Hitchcock 16,532, X 5; *d*, *Elodea titicacana* St. John, pistillate flower, from M. Bang 165, X 5; and *e*, the staminate flower, from the holotype, X 5.

subhyaline; petals 5.5-6.5 mm. long, 1.8-2 mm. wide, broadly spatulate, reflexed, white membranous, delicate; stamens all raised on a column 1 mm. in diameter; lower stamens six, sessile 3.2-3.5 mm. long, narrowly cylindric, the three inner ones raised on a common central stalk, the anthers 3.3-3.8 mm. long, narrowly cylindric; pistillate plants with spathes borne in the upper axils, 1-flowered, 13-16 mm. long, narrowly cylindric, not inflated, narrowed at base, the apex cleft 3 mm., the two terminal lobes divergent, elliptic-lanceolate, abruptly short pointed; flowers borne on a thread-like base of the hypanthium that becomes as much as 4 cm. in length; sepals 2.4-2.6 mm. long, 1-1.1 mm. wide, oblong, rounded and cucullate at tip, greenish, firm; petals 2.2-2.4 mm. long, 0.8 mm. broad, elliptic-spatulate, white, membranous and delicate; the three staminodia 0.8 mm. long, opposite the sepals, subulate, erect; stigmas three, 3.5-4.5 mm. long, each parted almost to the base into two linear, hirsutulous lobes; capsule 6 mm. long, 2.5 mm. in diameter, elliptic-ovoid, tipped with a slender beak 5 mm. long; seeds 5 mm. long, brownish, linear-cylindric, acuminate and tailed at one end.

Holotypus: "In aqua fluente rivulorum. In Peruviae ditione Ubuamantaga, prov. Canta, *Matthews* no. 581". (K). Specimen examined!

Specimens Examined: Ecuador, vicinity of Cuenca, Sept. 17-24, 1918, *J. N. Rose, A. Pachano & G. Rose 22,823* (GH, NY); in Andibus, 1857-9, *R. Spruce 5,458* (B, P, S).

Bolivia: Ulloma, Prov. Pacajes, Dep. La Paz, 3,800 m. alt., 6/8, 1920, *E. Asplund 72* (G, S); Guaqui, Prov. Ingavi, Dep. La Paz, dike, 3,850 m. alt., 1/2, 1921, *E. Asplund 2,275* (S); ditto, 11/4, 1921, *E. Asplund 3,449* (B, S); Panacachi, cantón Ulloma, Prov. Pacajes, 3,850 m. alt., 24/2, 1921, *E. Asplund 2,595* (S); nom. vern. "yota", Tiquina, Laguna de Titicaca, Jan. 1865, *A. Raimondi 10,506* (B).

Peru: Temple of Virachoca, near Tinta, in a spring, 3,500 m. alt., April 15, 1915, *O. F. Cook & G. B. Gilbert 195* (US); Colinas del Saxarhuamán, near Cuzco, 3,500 m. alt., Nov. 3, 1929, *F. L. Herrera 217* (US); nom. vern. "chinki", alrededores de la ciudad, Chchinqui, Cuzco, 3,400-3,500 m. alt., Nov. 1924, *F. L. Herrera 427* (B); alrededores de la ciudad, Prov. de Cuzco, crece en una fuente, 3,700-3,900 m. alt., Abril 1925, *F. L. Herrera 662* (B); Azangaro, in aquis lente fluentibus, Jun., *W. Lechler 3,144* (B); Laguna de Titicaca, Dep. de Puno, y aguas estancadas, sirve de alimento para las vacas, 18--, *A. Raimondi 9,524* (B).

10. **Elodea peruviensis** sp. nov. (sect. *Elodea*), (figs. 3, a, b, 5, g, h, 6, 8).

Diagnosis Holotypi: Planta aquatica submersa, caulibus gracilibus ramis dichotomis, foliis inferis 3 mm. longis 1.3 mm. latis ovatis oppositis,

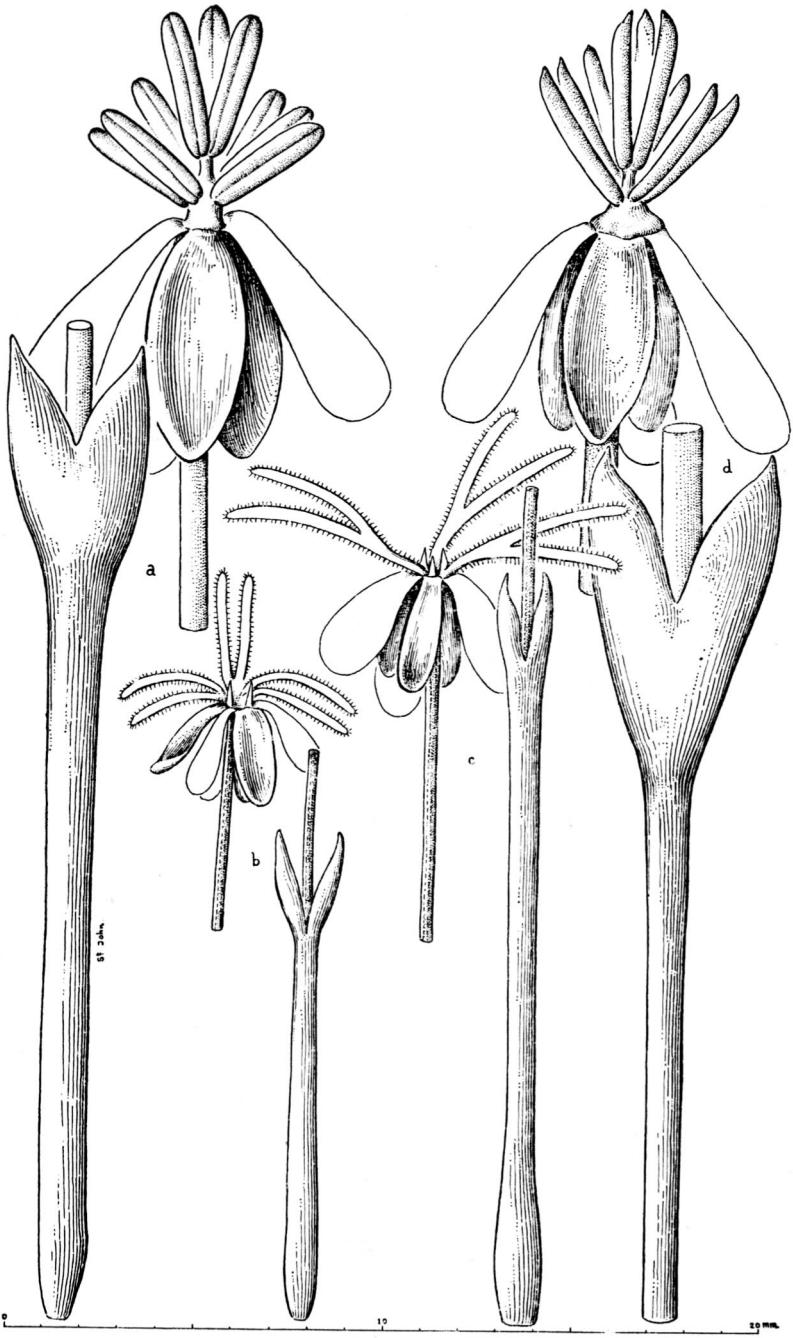

Fig. 4. *a, Elodea Matthewsii* (Planch.) St. John, staminate flower, from E. Asplund 3,449, X 5; and *b*, the pistillate flower, from A. Raimondi 9,524, X 5; *c, Elodea Potamogeton* (Bert.) Espinosa, pistillate flower, from holotype, X 5; and *d*, staminate flower, from C. Gay, isotype (G), X 5.

foliis medialibus et superis 9-15 mm. longis 1-1.9 mm. latis tribus in verticillis linearibus acutis vel subacutis ciliato-serratis praesertim ad apicem viridibus membranaceis flaccidis paene imbricatis plerumque divergentibus, floribus dioicis, spathis masculis in axillis superis ferrentibus parte supera 6 mm. longa 3 mm. lata anguste ellipsoidea inflata profunde bilobata, parte infera cuneata et in basi 9-12 mm. longa 0.8 mm. diametro pedunculacea attentuata, floribus singulis in basi hypanthii 3-4 cm. longa filiformi productis, sepalis 5.1 mm. longis 3.5 mm. latis ovatis subfoliaceis cucullatis nigro-purpureo-striatis, petalis 5.5 mm. longis 1.5 mm. latis cuneatis spatulatis albis membranaceis, staminibus 9 in seriebus tribus affixis, 3 infimis circum basem columnae filamentaceae eis 3.3 mm. longis, 3 medialibus 3 mm. longis, 3 superis 3.5 mm. longis in apice columnae 1.5 mm. longae affixis, granis pollinis minutis ellipsoideis.

Diagnosis of Holotype: Submerged aquatic; stem slender, dichotomously branching; lower leaves 3 mm. long, 1.3 mm. wide, opposite; median and upper leaves 9-15 mm. long, 1-2.2 mm. broad, in whorls of three, linear, acute to subacute, ciliate-serrate, especially towards the tip, bright green, thin, flaccid, mostly divergent and scarcely imbricate; flowers dioecious; staminate spathes borne in the upper axils, the upper portion inflated, narrowly ellipsoid, 6-7 mm. long, 3-4 mm. broad, deeply cleft, with a gaping, mouth-like orifice, the lower portion narrowed into a slender, peduncle-like base, 9-15 mm. long, 0.8 mm. in diameter; staminate flowers peduncled by the slender, thread-like hypanthium 3-4 cm. long; sepals 5.1 mm. long, 3.5 mm. broad, ovate, somewhat foliaceous, dark purple-striate, cucullate; petals 5.5 mm. long, 1.5 mm. broad, white, very thin and filmy, cuneate spatulate; staments nine, borne in three series of three each, the lower and outer three attached around and near the base of the monadelphous stalk, these outer anthers 3.3 mm. long, linear, the middle three 3 mm. long, the inner three 3.5 mm. long, attached on top of the common stalk which is 1.5 mm. long; pollen grains minute, ellipsoid.

Holotypus: Peru, Juliaca, 12,550 ft. alt., May 16, 1902, *R. S. Williams 2,516* (NY).

Description of Pistillate Plants: Pistillate spathes 14-26 mm. long, narrowly cylindric, becoming ellipsoid at base at maturity due to the enlarging of the capsule, the spathe deeply cleft at tip, usually as much as one third the length of the spathe; pistillate flowers peduncled by the thread-like hypanthium which becomes 5 or more cm. in length; sepals 2.5-3 mm. long, oblong-elliptic, somewhat cucullate, opaque towards the tip; petals 3-3.3 mm. long, 1-1.4 mm. wide, white, very filmy, broadly spatulate; staminodia three, 0.9 mm. long, acicular; stigmas three, 3-4 mm.

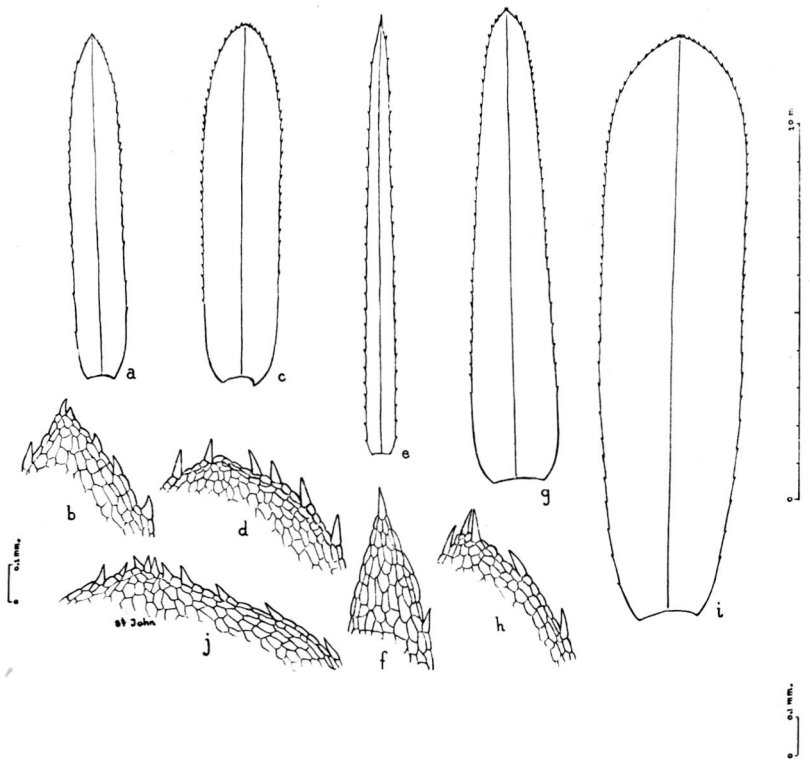

Fig. 5. *a*, *Elodea Matthewsii* (Planch.) St. John, leaf, from A. Raimondi 9,524, X 5; and *b*, leaf apex of same, X 50; *c*, *Elodea titicacana* St. John, leaf from holotype, X 5; and *d*, leaf apex of same, X 50; *e*, *Elodea granatensis* Humb. & Bonpl., leaf, from holotype, X 5; and *f*, leaf apex of same, X 50; *g*, *Elodea peruviensis* St. John, leaf, from holotype, X 5; and *h*, leaf apex of same, X 50; *i*, *Elodea Potamogeton* (Bert.) Espinosa, leaf, from isotype (P), X 5; and *j*, leaf apex of same, X 50.

long, each parted nearly to the base into two linear lanceolate flat lobes, ciliate; capsule 7 mm. long, 3 mm. wide, ellipsoid; seeds about six, 3.5 mm. long, cylindric.

Specimens Examined: Peru, colinas del Saraihuamán, 3,500-3,800 m. alt., March 1925, *F. L. Herrera 537* (US); Juliaca, 12,550 ft. alt., May 16, 1902, *R. S. Williams 2,516* (BM, US). These have the same data and number as the holotype, and should be isotypes, but they are pistillate plants.

Bolivia: Formatio Meränenseen, Hochseen des oberen La Paz-Tales, Choqueaputal bei La Paz, June 22, 1926, *C. Troll 2,321* (B); Desaguadera delta, 3,700 m. alt., Dec. 15, 1926, *C. Troll 3,043* (B).

Discussion: *E. peruviensis* is a member of the section *Elodea*. The closest relative is *E. Matthewsii* (Planch.) St. John and this species also occurs from Ecuador to Bolivia. It has the leaves firm, the staminate spathes 18-26 mm. long, the staminate petals 1.8-2 mm. wide, the anthers in 2 series, and the pistillate petals 0.8 mm. broad.

11. **Elodea Potamogeton** (Bert.) Espinosa, Rev. Chil. Hist. Nat. 31: 150, 1928; *E. Potamogeton* (Bert.) Macbr., Field Mus., Publ. Bot. 11 (1): 4, 1931; *Diplandra Potamogeton* Bertero, Mercurio Chileno 13: 612, 1829; Ferrusac, Bul. Sci. Nat. & Geol. 20: 110, 1830; *Anacharis chilensis* Planch., Ann. & Mag. Nat. Hist. II, 1: 86. 1848; *Elodea chilensis* (Planch.) Casp., K. Preuss. Akad. Wissensch., Monatsber. 1857: 47, 1857; and in reprint, p. 11, 1857; *Luchia Berteroniana* Steud., Nomencl. Bot. ed. 2, 2: 75. 1841, a nomen nudum; *A. Potamogeton* (Bert.) Victorin, Univ. Montréal, Lab. Bot., Contrib. 18: 41, 1931. (Figs. 4, c, d, 5, i, j, 7, 8).

Description of All Specimens Examined: Submerged aquatic; stems slender, dichotomously branching above; lower leaves 2-4 mm. long, 1-2 mm. wide, opposite; median and upper leaves 8-20 mm. long, 2-4.5 mm. wide, in whorls of 3-4, linear oblong to spatulate oblong, obtuse or subacute, minutely serrulate, dark green, firm, near the stem tips closely crowded and somewhat imbricate but the tips recurved, as are the leaves lower down on the stem; flowers dioecious; staminate plants with spathes borne from the upper or middle axils, 20-27 mm. long, the lower part cylindric, peduncle-like, 1 mm. in diameter, the upper part inflated, gaping, funnelform, 8-9 mm. long, 3.5-5 mm. wide, the apex bidentate, gaping, cleft for 3-4 mm.; staminate flowers peduncled by the slender, thread-like hypanthium, exserted, up to 15 cm. in length; sepals 4.5-5.5 mm. long, 1.8-2.5 mm. broad, oblong-elliptic, concave, slightly cucullate, firm, greenish, somewhat dark or purplish tinged at tip; petals 6.5 mm. long.

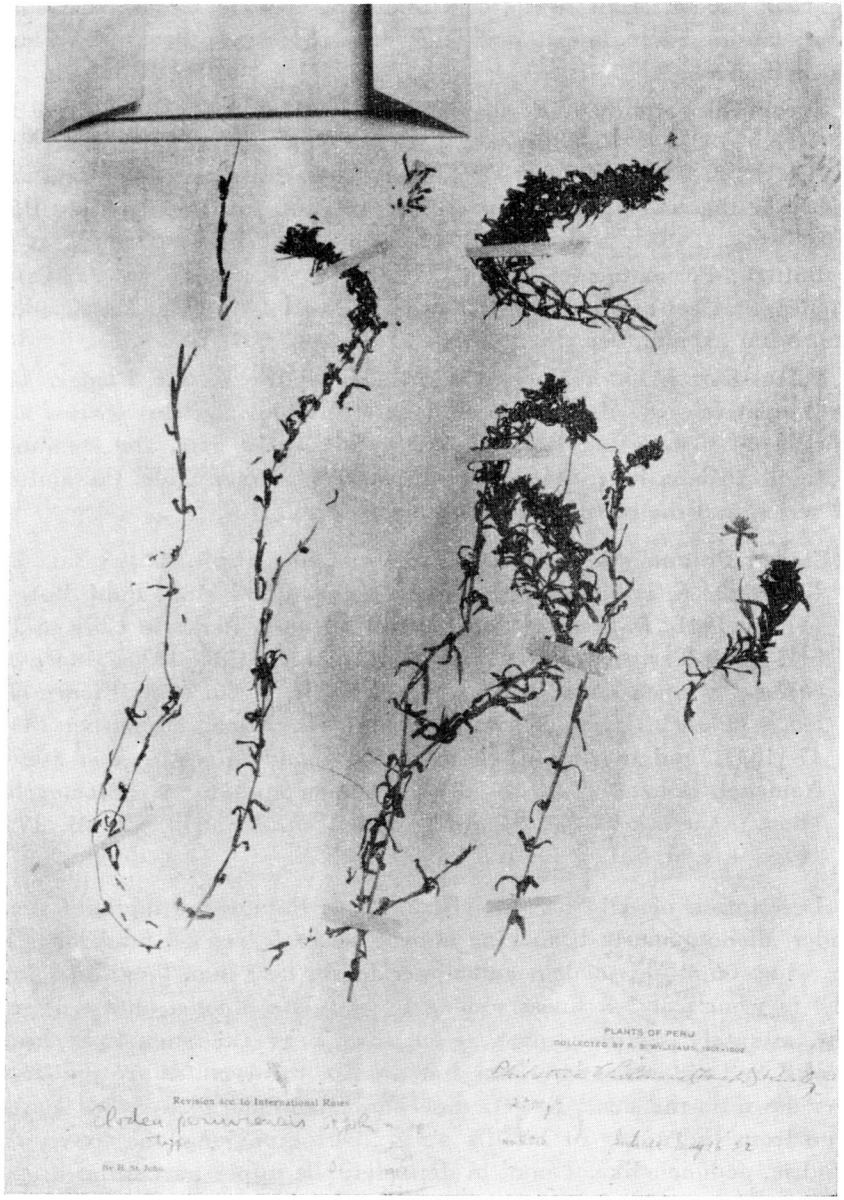

Fig. 6. *Elodea peruviensis* St. John, photo of holotype.

1.7 mm. wide, cuneate spatulate, white, membranous; stamens nine, borne on a central, conical common stalk, the six lower in a ring about its middle, the anthers 4 mm. long, linear-oblong, acute, the three central stamens on the apex of the common stalk and 4 mm. long, linear-oblong, erect, incurved-apiculate; pistillate plants with spathes 17-22 mm. long, slender subcylindric, becoming slightly distended at base around the ovary and at the bidentate tip; pistillate flowers borne on the slender, thread-like hypanthium which lengthens to as much as 10 cm.; sepals 3-3.1 mm. long, 1.1-1.2 mm. wide, narrowly elliptic, nearly flat, rather firm, greenish and more or less streaked with dark purplish; petals 3.5 mm. long, 1.5 mm. wide, spatulate-elliptic, membranous, purple except for the whitish lower half; staminodia three, 0.7 mm. long, subulate; stigmas three, 3.5-5 mm. long, bifid for about $^2/_3$ of their length, strap-shaped and almost membranous, the margins red, viscid hirsutulous from tip to base.

Holotype: Chile, "en las aguas claras de las acequias de la Quinta, Corcolen y Taguatagua. Bertero". The holotype seems to be that from Chili: In aquis lente fluentibus, Tagua Tagua, 1829, *Bertero 225* (P). Type examined! There are several isotypes: one giving the locality as Coriolen, one giving the date as Obr. 1828, another as Sept. 1828 (BM, G, P).

Specimens Examined: Bolivia, Calacoto, Prov. Pacajes, Dep. La Paz, ca. 3,800 m. alt., *E. Asplund 2,815* (S, US); Omasuyos, vicinis Achacache, Sagchani, reg. alpina, in canalibus, 2,925 m. alt., Jul. 1858, *G. Mandon 1,461* (BM, G, P); Lac de Titicaca, *A. D'Orbigny* (P).

Peru: Laguna de Capillocacha, planta acuática, en la laguna formando grandes asociaciones, 4,200 m. alt., Enero 8, 1949, *R. Ferreyra 5,206* (US); Carhuamayo, Prov. de Tarma, dep. de Junín, Riachuelo, 4,100-4,200 m. alt., Enero 9, 1949, *R. Ferreyra 5,243* (US); Huambulio, Dept. Cuzco, 3,100 m. alt., Aug. 1928, *F. L. Herrera 2,082* (G, S); Valle de Oropesa, Dep. Cuzco, 3,100 m. alt., Aug. 1928, *F. L. Herrera 2,082* (S, US); La Oroya, prov. Tarma, Dep. Yunin, flutend in Bächen, 3,700-3,800 m. alt., Feb. 1903, *A. Weberbauer 2,581* (B).

Chile: prope Valparaiso, 1832, *Cuming 636* (BM), the type of *Anacharis chilensis* Planch.; Chillan, in a shallow river, Jan. 1904, *S. Elliot 340* (BM); orillas del río Mapocho, Prov. Santiago, Feb. 15, 1936, *M. R. Espinosa B.* (SGO); in flutatilis natans, Taguatagua, Prov. Colchagua, 1831, *C. Gay 166* (NY, P); without data, *C. Gay 166* (BR, MO, NY, P); Colchagua, 1831, *C. Gay* (P); de Draguignan, sent in 1833, *C. Gay* (G); Maypu, aqua fluente rivulorum, 1834-1842, *C. Gay* (G); without locality, *C. Gay* (B, BR, G, P); Pleñaflor, prov. de Santiago, crece en el agua, arraigada, 400 m. alt., Jan. 6, 1935, *G. Looser 3,372* (Herb. Looser); with-

Fig. 7. *Elodea Potamogeton* (Bert.) Espinosa, photo of holotype.

out data, *R. A. Philippi 87* (O); Melipilla, 1859, *R. A. Philippi 682* (BM, G, O, P); Santiago, dedit 1875, *Philippi* (B); nom. vulg. "luchi", Esmeraldas, 19 May 1875, *E. C. Reed* (BM).

Discussion: There is a specimen with doubtful data and mixed material, labeled as from Ecuador: crescit cum praeced. ibid., *A. Sodiro* 195/2 in part (B). I discredit it as it is mixed with *E. peruviensis* which may well have come from Ecuador.

12. **Elodea titicacana** sp. nov. (sect. *Elodea*), (figs. 3, d, e, 5, c, d, 8).

Diagnosis Holotypi: Planta aquatica submersa, foliis inferioribus oppositis 3-4 mm. longis 1.3 mm. latis minute serrulatis, ovatis, bracteatis, foliis medialibus et superis 7-14 mm. longis 1-1.7 mm. latis tribus in verticillis anguste oblongis vel oblongo-lanceolatis obtusis vel subacutis viridibus membranaceis flaccidis serrulatis, floribus doicis, planta mascula cum spathis in axilibus superis parte infera diminuenti in basi gracili pedunculiformi, parte supera 7 mm. longa 3 mm. lata obovoidea inflata apice bidentato et buccam apertam simulanti, floribus masculis ex hypanthio gracili filiformi gerentibus, sepalis 4.3 mm. longis 1.8 mm. latis ellipticis nigro-striatis, petalis 5.2 mm. longis 1.5 mm. latis oblanceolatis albis membranaceis, staminibus 9 eis exterioribus 6 separatis antheris 2.2 mm. longis lineari-oblongis, illis interioribus 3 in apice columnae communis elevatis antheris 3 mm. longis.

Diagnosis of Holotype: Submerged aquatic; stem slender; lower leaves opposite, 3-4 mm. long, 1.3 mm. wide, very minutely serrulate, small, bract-like, ovate; median and upper leaves 12-14 mm. long, 1-1.7 mm. broad, in whorls of 3, narrowly oblong or oblong-lanceolate, obtuse or subacute, bright green, thin, flaccid, finely serrulate; flowers dioecious; staminate plants bearing in the upper axils the spathes, the lower half narrowed into a slender peduncle-like base, the upper half 7 mm. long, 3 mm. wide, inflated, obovoid, the apex bidentate, resembling a gaping mouth; staminate flowers peduncled by the slender, thread-like hypanthium 5 cm. long; sepals 4.3 mm. long, 1.8 mm. wide, elliptic, dark-striate; petals 5.2 mm. long, 1.5 mm. wide, white, very delicate, oblanceolate, exceeding the sepals; stamens 9, the outer 6 separate, their linear oblong anthers 2.2 mm. long, the inner 3 raised on a common, fused stalk, their anthers 3 mm. long.

Holotypus: Bolivia, vic. La Paz, Lake Titicaca, 13,000 ped., 1890, *M. Bang 165* (PH). Isotype (L)!

Description of All Specimens Examined: Pistillate plants bearing spathes 16 mm. long, narrowly cylindric, becoming somewhat urn shaped

at base at maturity by the ripening capsule, the spathe shortly bidentate at the tip; pistillate flowers peduncled by the slender, thread-like hypanthium that becomes 6 or more cm. in length; sepals 2.5 mm. long, 1.1 mm. broad, ellipsoid, cucullate, dark-striate; petals 2 mm. long., 1.1 mm. wide, white, very delicate, elliptic-oblong; staminodia 3, slender, bidentate; stigmas 3, oblong, obtuse, entire, faintly papillose above on either side of the middle.

Specimens Examined: Bolivia, vic. La Paz, Lake Titicaca, 13,000 ped., *M. Bang 165* (F, GH, M, NY, P, US, Z). These were distributed as duplicates of the holotype, but are either sterile or pistillate. All are in a mass intermingled of intermingled *Elodea* and *Myriophyllum*. The label of one sheet (F) still bears the printed locality La Paz which has not been changed to Lake Titicaca. Also one duplicate in the Delessert Herbarium, Geneva, was labelled *Tagetes multiflora*.

LIST OF EXSICCATAE

After the collector's name and initials is the number of the collection, or if it is without number, *s. n.* for sine numero. Following this is a number in parentheses, the number of the species as presented in this part of the monograph.

Asplund, E. 72 (9)
2,275 (9)
2,595 (9)
2,815 (11)
3,449 (9)
Bang, M. 165 (12)
Bertero, 225 (11)
s. n. (11)
Bonpland, A. 1,757 (8)
Brade, A. C. 5,795 (8)
6,409 (8)
Bünzli, G. H. s. n. (8)
Cook, O. F. & G. B. Gilbert 195 (9)
Cuming, 636 (11)
D'Orbigny, A. s. n. (11)
Dryander, E. 2,618 (8)
Elliot, S. 340 (11)
Espinosa, B., M. R. s. n. (11)
Ferreyra, R. 5,206 (11)
5,243 (11)
Focke, 602 (8)
Gay, C. 166 (11)
s. n. (11)
s. n. (11)
s. n. (11)
s. n. (11)
Gehrt, A. 3,333 (8)
Glaziou, A. 13,290 (8)
14,355 bis (8)
22,230 (8)
Glaziou, A. & R. Letegrier 22,229 (8)
Herrera, F. L. 217 (9)
427 (9)
537 (10)
662 (9)
2,082 (11)

GOODE'S SERIES OF BASE MAPS AND GRAPHS. SOUTH AMERICA ON THE SINUSOIDAL PROJECTION. NO. 203
80
70
60
50
40 LONGITUDE WEST OF GREENWICH
10
0
EQUATOR
10
20
30
40
50
VENEZUELA
COLOMBIA
BRITISH GUIANA
SURINAM
FRENCH GUIANA
ECUADOR
PERU
BRASIL
BOLIVIA
CHILI
ARGENTINA
LEGEND
E. MATTHEWSII.
E. POTAMOGETON
E. TITICACANA.
E. PERUVIENSIS.
E. GRANATENSIS.
SCALE
MILES
KILOMETERS
90
80
70
60
50
40
30
LONGITUDE WEST 20 OF GREENWICH

FIG. 8

Hitchcock, A. S. 16,532 (8)
Hoehne, F. C. 19,260 (8)
20,549 (8)
s. n. (8)
Holton, I. F. 138 (8)
Jenman, 4,791 (8)
Jussieu, s. n. (8)
Killip, E. P. 37,595 (8)
Lechler, W. 3,144 (9)
Lehmann, F. C. 2,287 (8)
Leprieur, 26 (8)
138 (8)
s. n. (8)
s. n. (8)
Loefgren & Edwall 2,562 (8)
Looser, G. 3,372 (11)
Luetzelburg, s. n. (8)
Mandon, G. 1,461 (11)
Martius, von. 453 (8)
s. n. (8)
Martyn, E. B. 425 (8)
Matthews, 581 (9)
Mendonça, R. 688 (8)
Mosén, H. 3,479 (8)
Nuderlein, G. s. n. (8)
Parker, s. n. (8)
Passarge & Selwyn,
s. n. (8)
Perrottet, 198 (8)
Philippi, R. A. 87 (11)
682 (11)
s. n. (11)
Raimondi, A. 9,524 (9)
10,506 (9)
Reed, E. C. s. n. (11)
Richard, s. n. (8)
Riedel, 848 (8)
Robert, A. s. n. (8)
Rose, J. N., A. Pachano & G. Rose
22,823 (9)
Saint-Hilaire, A. de B1,591 (8)
s. n. (8)
Sellow, s. n. (8)
Sodiro, A. 195/2 (11)
Splitgerber, F. L. s. n. (8)
Spruce, R. 1,991 (8)
5.458 (9)
Stübel, A. 194c (8)
Troll, C. 2,321 (10)
3,043 (10)
Tutin, T. G. s. n. (8)
Ule, E. 4,074 (8)
7,758 (8)
Usteri, A. s. n. (8)
Warming, E. 1,103 (8)
s. n. (8)
Weberbauer, A. 2,581 (11)
Weddell, H. A. 3,367 (8)
Williams, R. S. 2,516 (10)